2. Program Elements

2.1 DELTA LEVEE BASE LEVEL PROTECTION PLAN

The goal of the Delta Levee Base Level Protection Plan (Base Level Protection) element is to improve all Delta levees to a uniform base level standard. This element is being developed and evaluated at a programmatic level. More focused analysis and documentation of specific targets and actions will occur in subsequent efforts.

The goal of the Delta Levee Base Level Protection Plan element is to improve all Delta levees to a uniform base level standard.

2.1.1 INTRODUCTION

The Delta Levee Maintenance Subventions Program was established in 1973 and amended by the Delta Flood Protection Act of 1988. The Delta Flood Protection Fund was created to provide for local assistance under the Delta Levee Maintenance Subventions Program (Subventions Program), and for Special Delta Flood Protection Projects (Special Projects). Currently, the Subventions Program and Special Projects are being carried forward under funding provided by the Safe, Clean, Reliable Water Supply Act, Division 24 of the California Water Code. Delta levee maintenance is described in the California Water Code, Division 6, Part 9 - Delta Levee Maintenance (commencing with Section 12980). (Refer to Appendix C for pertinent excerpts from the California Water Code.) It is the intent of the California Legislature that, to the extent allowed by existing requirements, levee rehabilitation will be consistent with CALFED's Delta ecosystem restoration strategy. (Refer to subsequent discussion of "Funding.")

Table 2 lists implementation objectives, targets, and actions associated with the Base Level Protection element.

2.1.2 SCOPE

Approximately 385 miles of project levees and 715 miles of non-project levees are located in the legal Delta (Figures 2 and 3). "Project levees" are levees that were improved or adopted as part of federal flood control projects. Most of the project levees are along the

Table 2. Implementation Objectives, Targets, and Actions Associated with the Delta Levee Base Level Protection Plan

Implementation Objective	Target	Action
Uniformly improve Delta levees	Improve Delta levee system stability to meet PL 84-99 criteria	Modify levee cross sections by raising levee height, widening levee crown, flattening levee slopes, or constructing stability berms
	Maintain Delta levees to the PL 84-99 standard	Develop a long-term maintenance plan
Establish a stable funding source	Provide necessary funding to improve and then maintain Delta levees to the PL 84-99 standard for the CALFED planning horizon	Prepare cost estimates
		Identify beneficiaries to provide equitable distribution of costs
		Develop funding sources
Coordinate the permitting process	Reduce the time required to acquire all necessary permits	Develop a uniform process to coordinate and approve all permits
		Provide regional mitigation banking
		Coordinate with the Ecosystem Restoration Program to provide an environmental enhancement component

Sacramento and San Joaquin Rivers in the upper reaches of the Delta. (The California Water Code definition of "Project Levees" is provided in the glossary.) "Non-project levees" are all levees that are not project levees.

It is assumed that most of the project levees meet or exceed the PL 84-99 standard. The current (1998) cost estimate indicates that approximately 520 miles of levee will need to be rehabilitated and brought up to PL 84-99 standards. All 1,100 miles of levees should be routinely inspected and maintained. Table 3 (at the end of this report) includes an inventory of Delta levees that identifies project and non-project levees, responsible reclamation districts, and the existing levees considered up to the PL 84-99 standard.

Base level protection will be achieved through an extension of the existing Subventions Program defined in the California Water Code, commencing with Section 12980 (refer to Appendix C), except that CALFED recommends selection of the Corps' PL 84-99 Delta Specific Standard as the minimum base level standard. The Delta-specific criteria are contained in the Corps' document titled, "Guidelines For Rehabilitation of Non-Federal Levees in the Sacramento-San Joaquin Legal Delta" (1988). Constructing levees to the PL 84-99 criteria is a prerequisite for, but not a guarantee of, postflood disaster assistance. (Appendix A contains information on the PL 84-99 Delta Specific Standard.)

Figure 4 compares the PL 84-99 Delta Specific Standard to other levee standards.

Figure 2

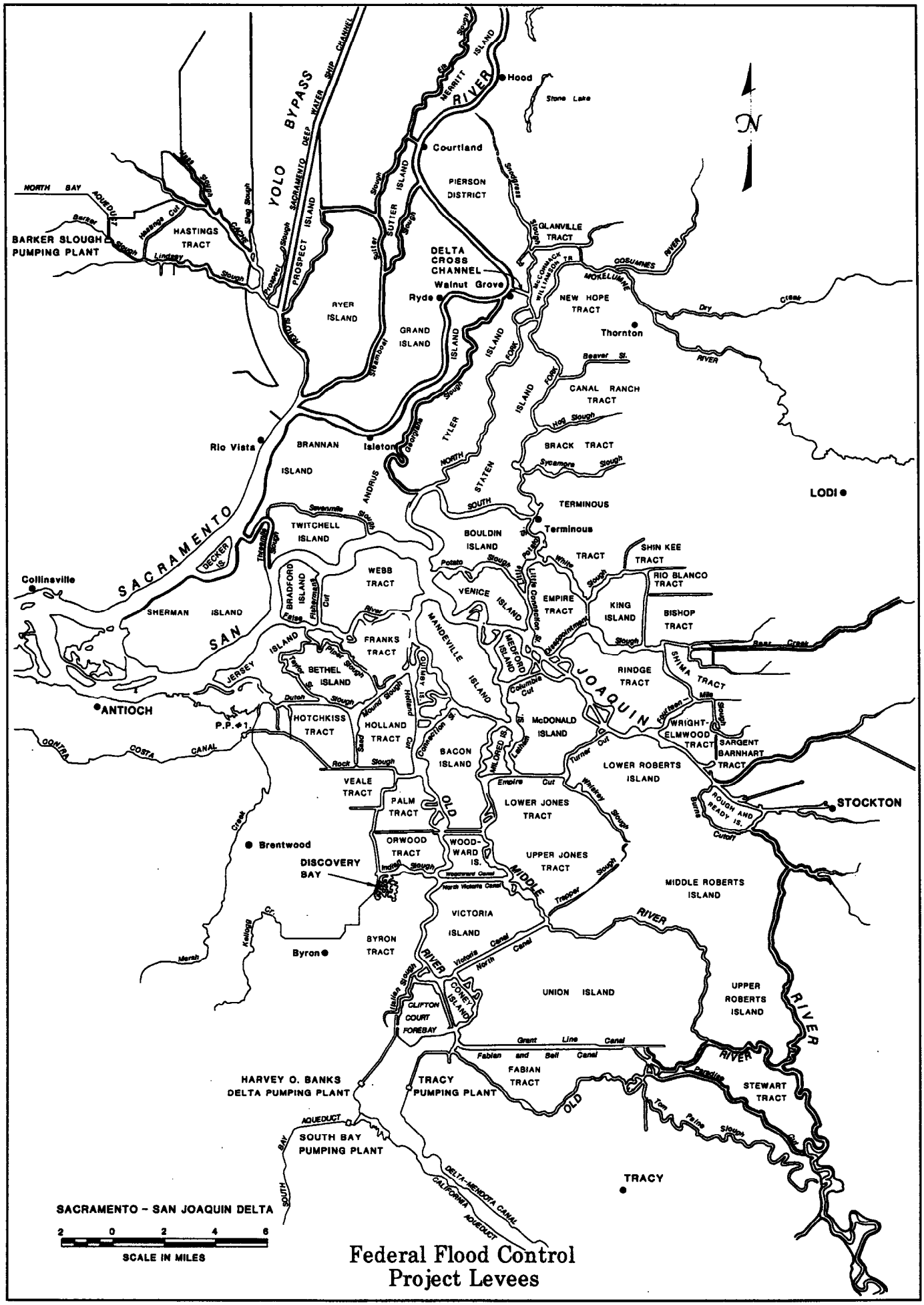
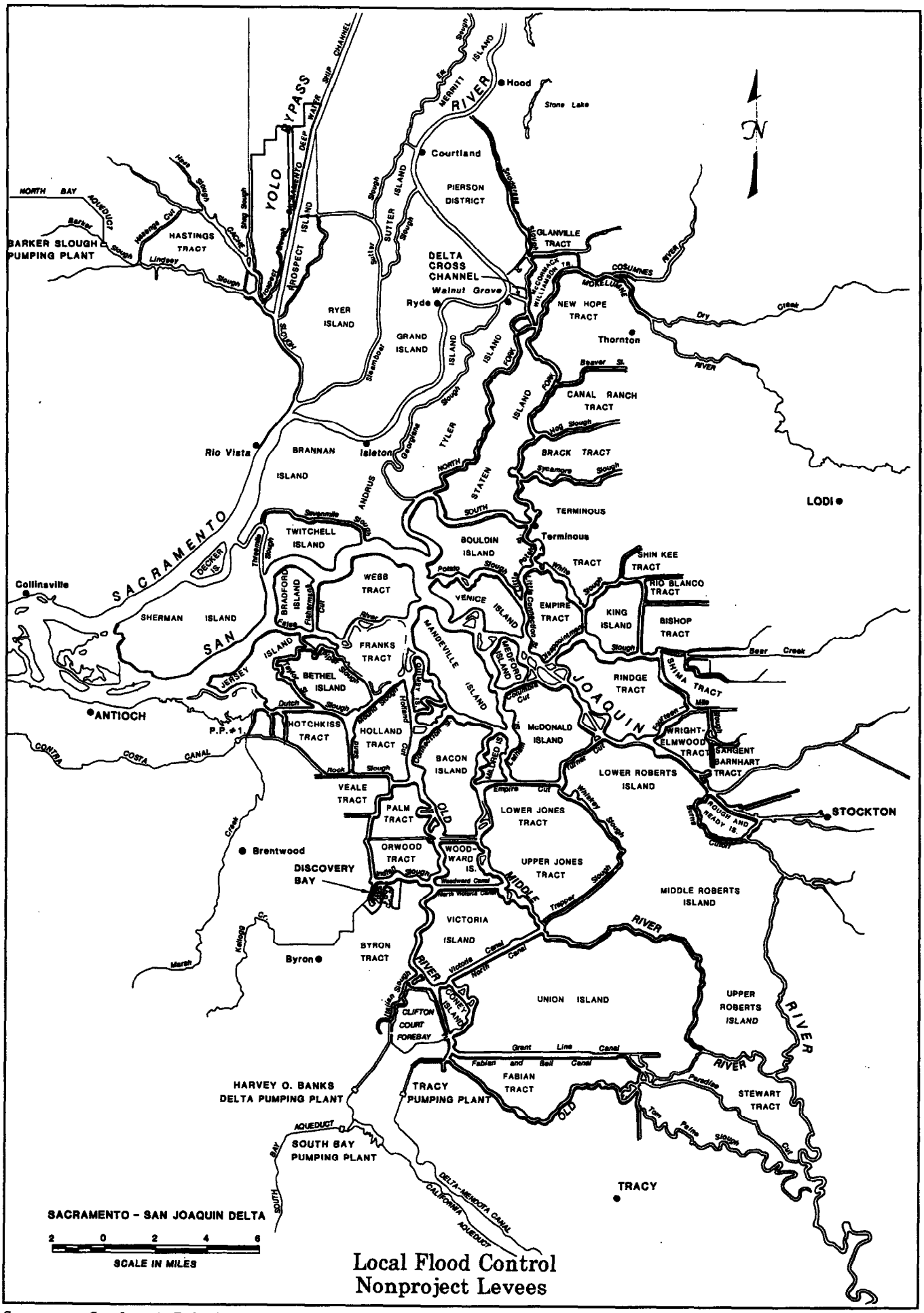

YOLO BYPASS
SACRAMENTO RIVER
DEEP WATER SHIP CHANNEL
MERRITT ISLAND
Hood
Stone Lake
Courtland
PIERSON DISTRICT
Sutter Slough
SUTTER ISLAND
Steamboat Slough
Sacramento Slough
PROSPECT ISLAND
Prospect Slough
Shag Slough
CACHE Slough
Lindsey Slough
Barker Slough
NORTH BAY AQUEDUCT
Hastings Cut
HASTINGS TRACT
BARKER SLOUGH PUMPING PLANT
RYER ISLAND
Ryde
DELTA CROSS CHANNEL
Walnut Grove
GLANVILLE TRACT
Snodgrass Slough
McCONNACK TR
WILLIAMSON TR
COSUMNES RIVER
MOKELUMNE
NEW HOPE TRACT
Thornton
Dry Creek
Beaver St.
CANAL RANCH TRACT
Hog Slough
BRACK TRACT
Sycamore Slough
GRAND ISLAND
Georgiana Slough
TYLER ISLAND
NORTH FORK
SOUTH FORK
LODI
Rio Vista
BRANNAN ISLAND
Isleton
ANDRUS ISLAND
TWITCHELL ISLAND
Sevenmile Slough
Threemile Slough
DECKER IS.
SACRAMENTO
SAN JOAQUIN
Collinsville
SHERMAN ISLAND
BRADFORD ISLAND
False River
Fisherman's Cut
WEBB TRACT
FRANKS TRACT
Piper Slough
Trapper Slough
JERSEY ISLAND
BETHEL ISLAND
Dutch Slough
ANTIOCH
P.P.#1
HOTCHKISS TRACT
HOLLAND TRACT
Sand Cut
Rock Slough
CONTRA COSTA CANAL
VEALE TRACT
PALM TRACT
OLD
Brentwood
ORWOOD TRACT
Indian Slough
DISCOVERY BAY
Kellogg Cr.
Marsh Creek
Byron
BYRON TRACT
Victoria Canal
North Victoria Canal
VICTORIA ISLAND
Little Connection Slough
CLIFTON COURT FOREBAY
HARVEY O. BANKS DELTA PUMPING PLANT
AQUEDUCT
SOUTH BAY PUMPING PLANT
SOUTH BAY
TRACY PUMPING PLANT
Grant Line Canal
Fabian and Bell Canal
FABIAN TRACT
DELTA-MENDOTA CANAL
CALIFORNIA AQUEDUCT
TRACY
Old River
Middle River
Connection Slough
Woodward Canal
WOODWARD IS.
UPPER JONES TRACT
LOWER JONES TRACT
Empire Cut
Whiskey Slough
MIDDLE ROBERTS ISLAND
UPPER ROBERTS ISLAND
UNION ISLAND
CONEY ISLAND
Little Potato Slough
Potato Slough
BOULDIN ISLAND
Terminous
TERMINOUS TRACT
SHIN KEE TRACT
RIO BLANCO TRACT
VENICE ISLAND
EMPIRE TRACT
KING ISLAND
BISHOP TRACT
MANDEVILLE ISLAND
MEDFORD ISLAND
Disappointment Slough
Columbia Cut
RINDGE TRACT
SHIMA TRACT
Bear Creek
Mormon Slough
McDONALD ISLAND
WRIGHT-ELMWOOD TRACT
SARGENT BARNHART TRACT
LOWER ROBERTS ISLAND
Turner Cut
Mildred Isl.
Lathrop
Connection Slough
Holland Cut
Middle River
Empire Cut
Whiskey Slough
ROUGH AND READY IS.
Burns Cutoff
STOCKTON
Paradise Cut
STEWART TRACT
Tom Paine Slough
SACRAMENTO - SAN JOAQUIN DELTA
2 0 2 4 6
SCALE IN MILES
Federal Flood Control Project Levees
N

Figure 3


SACRAMENTO - SAN JOAQUIN DELTA
2 0 2 4 6
SCALE IN MILES
Local Flood Control
Nonproject Levees
N
Hood
Courtland
Stone Lake
PIERSON DISTRICT
GLANVILLE TRACT
DELTA CROSS CHANNEL
Walnut Grove
Ryde
RYER ISLAND
GRAND ISLAND
NEW HOPE TRACT
Thornton
CANAL RANCH TRACT
BRACK TRACT
LODI
Rio Vista
BRANNAN ISLAND
Isleton
TERMINOUS
Terminous
BOULDIN ISLAND
SHIN KEE TRACT
RIO BLANCO TRACT
TWITCHELL ISLAND
Collinsville
SHERMAN ISLAND
WEBB TRACT
VENICE ISLAND
EMPIRE TRACT
KING ISLAND
BISHOP TRACT
FRANKS TRACT
MANDEVILLE ISLAND
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CONTRA COSTA CANAL
BACON ISLAND
LOWER ROBERTS ISLAND
VEALE TRACT
PALM TRACT
LOWER JONES TRACT
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ROUGH AND READY IS.
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VICTORIA ISLAND
BYRON TRACT
Byron
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UPPER ROBERTS ISLAND
CLIFTON COURT FOREBAY
CORNET ISLAND
HARVEY O. BANKS DELTA PUMPING PLANT
TRACY PUMPING PLANT
FABIAN TRACT
STEWART TRACT
SOUTH BAY PUMPING PLANT
TRACY
DELTA-MENDOTA CANAL
CALIFORNIA AQUEDUCT
BARKER SLOUGH PUMPING PLANT
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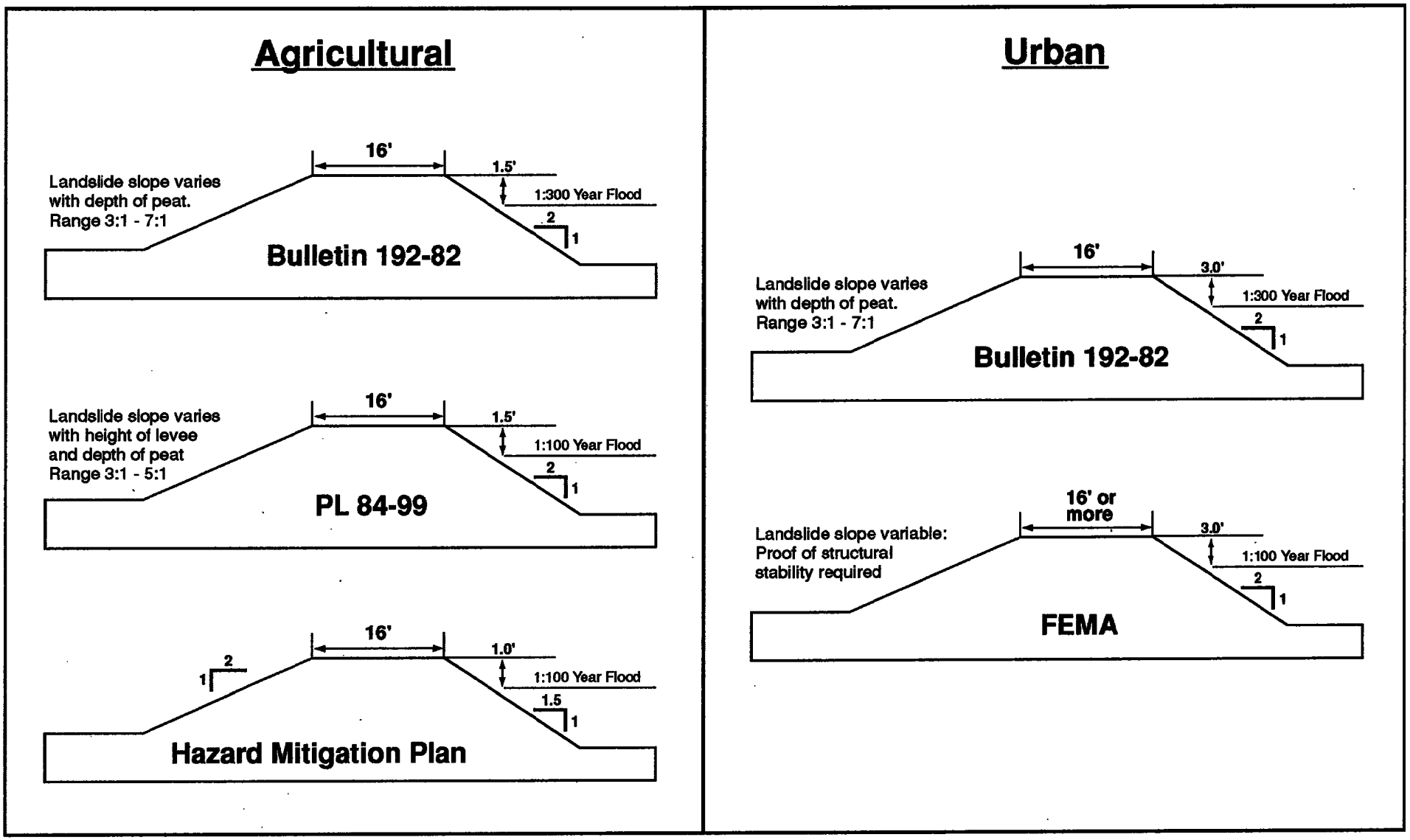
SACRAMENTO RIVER DEEP WATER SHIP CHANNEL
MERRITT ISLAND
SUTTER SLOUGH
PROSPECT SLOUGH
STEAMBOAT SLOUGH
GEORGIANA SLOUGH
TYLER ISLAND
NORTH FORK MOKELUMNE RIVER
SOUTH FORK MOKELUMNE RIVER
COSUMNES RIVER
Dry Creek
MISSOURI FLAT
DECKER IS.
BRADFORD ISLAND
OLD RIVER
MIDDLE RIVER
GRANT LINE CANAL
FABIAN AND BELL CANAL
VICTORIA CANAL
NORTH VICTORIA CANAL
WOODWARD CANAL
OLD RIVER
TOM PAINE SLOUGH CUT
PARADISE CUT
NORTH BAY AQUEDUCT
SOUTH BAY AQUEDUCT

Figure 4

Levee Standards



2.1.3 CRITERIA AND PROJECT APPROVAL

The State Reclamation Board has jurisdiction over all levee rehabilitation and maintenance and will be the local sponsor as required. The Board is authorized to make such rules and regulations that are necessary to carry out its responsibilities, consistent with the California Water Code.

The State will approve plans and inspect work to ensure that levees are effectively rehabilitated and maintained. Under the current code, the California Department of Water Resources (DWR) is responsible for developing the maintenance and rehabilitation criteria for non-project levees. The criteria will vary as required to meet specific conditions, and will embody and implement the "Flood Hazard Mitigation Plan for the Sacramento-San Joaquin Delta" (most current version) and the "Vegetation Management Guidelines for Local Non-Project Delta Levees" (most current version). In addition, DWR's Bulletin 192, dated May 1975 and updated in 1982, will be used as the conceptual plan guiding the formulation of projects to preserve the integrity of the Delta levee system. The criteria developed by DWR will be submitted to the Board for approval. Prior to adoption of any criteria, the Board will hold public hearings and may revise the criteria as it determines necessary.

The current California Water Code does not address project levee design and maintenance criteria. It is anticipated that the Corps will continue to be responsible for the design of project levees. The State and local agencies will be responsible for maintaining the levees in accordance with the PL 84-99 standard and with guidelines provided in the Corps' "Standard Operation and Maintenance Manual" (most current version) and in each applicable supplement for individual project units.

DFG will make a written determination as part of its review and approval of a plan or project whether the proposed work is consistent with a net long-term habitat improvement program and whether the project would result in a net benefit for aquatic species in the Delta.

2.1.4 AGREEMENTS

Before any plan is approved, agreement entered into, or state and federal funds expended, the local agency will enter into an agreement with the Board. This agreement will indemnify and hold and save the State, the Board, DWR, and any other agency or department of the State and Federal Governments and their employees free from any and all liability for damages, except that caused by gross negligence, that may arise out of the approvals, agreements, inspections, or work performed. Upon approval of project plans by the Board, the local agencies will enter into an agreement with the Board to perform the maintenance and improvement work, including the annual maintenance work, specified in the plan. Also, the Board will act as the local sponsor to the Corps and give the Corps the same assurances.

2.1.5 PROJECT PRIORITY

Local agencies will prioritize projects based on their individual needs. If applications for funding in any year exceed the funds available, the Board will apportion the funds among those levees or levee segments that are identified by DWR as most critical and beneficial,

Local agencies will prioritize projects based on their individual needs.

considering the needs of flood control, water quality, recreation, navigation, habitat improvement, and fish and wildlife.

2.1.6 MAINTENANCE

There is a difference between the maintenance standard as defined by the California Water Code and the PL 84-99 maintenance standard. This difference in maintenance standards may result in greater habitat mitigation and enhancement requirements.

The PL 84-99 maintenance standards may result in greater habitat mitigation and enhancement requirements.

Local agencies will be responsible for maintaining project and non-project levees. Local agencies will be eligible for reimbursement upon submission to and approval by the Board of plans for the maintenance and improvement of the project and non-project levees, including plans for the annual maintenance of the levees in accordance with the criteria adopted by the Board. The plans will (1) include provisions to acquire easements along levees that allow for the control and reversal of subsidence in areas where DWR determines that such an easement is desirable to maintain structural stability of the levee, (2) include provisions for protection of the fish and wildlife habitat determined necessary by DFG and that will not reduce the integrity of the levee, and (3) take into account the most recently updated Delta Master Recreation Plan prepared by the Resources Agency.

2.1.7 OVERSIGHT AND INSPECTIONS

DWR will conduct at least one annual inspection of every levee for which maintenance or improvement costs have been paid to the local agencies. In addition, DWR will inspect non-project levees of local agencies to monitor and ascertain the degree of compliance with, or progress toward meeting, the approved and agreed on criteria and standard. Whenever an inspection reveals that the specified and agreed upon maintenance is not being performed, DWR may establish a maintenance area and thereafter annually maintain the non-project levee in accordance with the Board-approved plan.

DWR will conduct at least one annual inspection of every levee for which maintenance or improvement costs have been paid to the local agencies.

The Corps may inspect project levees. For non-project levees to become eligible for federal assistance under PL 84-99, a local agency must request and pass an Initial Eligibility Inspection by the Corps. The Corps will inspect the levee to assess the integrity and reliability of the levee. The inspection by the Corps consists of a structural and geotechnical analysis, a hydrologic and hydraulic evaluation, and an operation and maintenance determination.

2.1.8 EMERGENCY RESPONSE

Even with rehabilitation and active levee maintenance, the threat of levee failure will continue to exist. Emergency Management and Response, a critical element of the Levee System Integrity Program Plan, is discussed in a later section of this plan.

2.2 DELTA LEVEE SPECIAL IMPROVEMENT PROJECTS

The goal of the Delta Levee Special Improvement Projects (Special Improvement Projects) element is to provide additional flood protection separate from the Base Level Protection element for Delta islands that protects such public benefits as water quality, the ecosystem, life and personal property, agricultural production, cultural resources, recreation, and local and statewide infrastructure. This element is being developed and evaluated at a programmatic level. More focused analysis and documentation of specific targets and actions will occur in subsequent efforts.

The goal of the Delta Levee Special Improvement Projects element is to provide additional flood protection separate from the Base Level Protection element for Delta islands that protects such public benefits as water quality, the ecosystem, life and personal property, agricultural production, cultural resources, recreation, and local and statewide infrastructure.

2.2.1 INTRODUCTION

The Special Improvement Projects element of the Levee System Integrity Program Plan will be carried out through an extension of the existing Special Projects Program as defined in the California Water Code.

The Delta Flood Protection Act of 1988 created the Special Flood Control Project Program. The Delta Flood Protection Fund was created to provide for local assistance under the Delta Levee Maintenance Subventions Program (Subventions Program), and for Special Delta Flood Protection Projects (Special Projects). Currently, the Subventions Program and Special Projects are being carried forward under funding provided by the Safe, Clean, Reliable Water Supply Act, Division 24f the California Water Code. Special Projects are described in the California Water Code, Division 6, Part 4.8 - Delta Flood Protection, Chapter 2 - Special Flood Control Projects (commencing with Section 12310). Refer to Appendix C for pertinent excerpts from the California Water Code. It is the intent of the Legislature that, to the extent consistent with existing requirements, special projects will be consistent with the Delta ecosystem restoration strategy of the CALFED program.

Funding for the Special Improvement Projects is discussed later in this report. Table 4 lists implementation objectives, targets, and actions associated with the Special Improvement Projects elements.

2.2.2 SCOPE

DWR is responsible for the existing state Special Projects Program and would continue to develop and implement the Special Improvement Projects element of the Levee Program. The primary purpose of the existing and proposed programs is to protect discrete and identifiable public benefits, including public highways and roads, utility lines and conduits, urbanized areas, water quality, recreation, navigation, and fish and wildlife habitat. Special Improvement Projects include flood control projects for (1) all the Delta islands, but primarily the key eight western and central islands of Bethel, Bradford, Holland, Hotchkiss, Jersery, Sherman, Twitchel, and Webb; (2) the Towns of Thorton and Walnut Grove; and (3) approximately 12 (more like 18) miles of levees on the islands bordering northern Suisun Bay from Van Sickle Island to Montezuma Slough. The Special Improvement Projects Program also must provide for a net long-term habitat improvement.

The Special Improvement Projects Program also must provide for a net long-term habitat improvement.

Project plans may include, or be a combination of, the improvement, rehabilitation, or modification of existing levees, and the conveyance of interests in land to limit or to modify land management practices that negatively affect flood control facilities. Easements will be obtained for the control and reversal of subsidence in areas along the levees where DWR determines that such an easement is desirable to maintain the structural stability of the levee. Project plans must include provisions for the protection of fish and wildlife habitat determined necessary by DFG and that do not reduce the integrity of flood control works.

2.2.3 PROJECT PRIORITY

In accordance with the California Water Code (Section 12313), DWR is required to develop, in consultation with appropriate federal, state, and local agencies, a list of areas where flood control work is needed to protect public facilities or provide public benefits. Priority of projects is to be based on the importance or degree of public benefit needing protection and the need for flood protective work. The list is now subject to the approval of the California Water Commission.

However, for the CALFED Program to achieve its objectives, this authority must be coordinated with the CALFED Program. The following change in the Water Code is suggested:

- The Levee Implementation Group (LIG), as established by CALFED, will develop a priority list of Special Improvement Projects consistent with the CALFED objectives and the primary purpose of the Special Flood Control Projects authority. The LIG is comprised of CALFED agencies and stakeholders to provide a forum for stakeholder and science review and to coordinate Levee Program actions with all other CALFED actions.

- The priority list will be approved by the CALFED Policy Group (or new CALFED umbrella authority).

Special Improvement Projects could be prioritized based on a matrix of objectives and island attributes. Such a matrix was developed by DWR with input from CALFED's Levee and Channel Technical Team. Table 5 presents such a matrix. A more detailed "Special Projects Information Matrix" is presented in Appendix D. This information demonstrates the scope and complexity involved in objectively prioritizing islands and projects. The existing matrix of objectives and island attributes (see Table 5) and the more detailed Special Projects information matrix (see Appendix D) presented in this Levee System Integrity Program Plan, would supplement a new CALFED priority matrix developed to support the CALFED objectives. The matrix of objectives, attributes, and priorities should be evaluated regularly to adapt to the changing Delta environment.

Special Improvement Projects could be prioritized based on a matrix of objectives and island attributes.

Table 4. Implementation Objectives, Targets, and Actions Associated with the Delta Levee Special Improvement Projects

Implementation Objective	Target	Action
Enhance flood protection for key islands that provide statewide benefits to the ecosystem, water supply, water quality, economics, infrastructure, etc.	Improve levee stability in key Delta locations to a level commensurate with the benefits which the levees protect	Modify levee cross sections by raising levee height, widening levee crown, flattening levee slopes, and/or constructing stability berms in key Delta locations
	Maintain improved levees	Develop a long-term maintenance plan
Establish a stable funding source	Provide necessary funding to improve and then maintain key levees for the CALFED planning horizon	Prepare cost estimates
		Identify beneficiaries to provide equitable distribution of costs
		Develop funding sources
Coordinate the permitting process	Reduce the time required to acquire all necessary permits	Develop a uniform process to coordinate and approve all permits
		Provide regional mitigation banking
		Coordinate with the Ecosystem Restoration Program to provide an environmental enhancement component

2.2.4 APPROVAL OF PLANS FOR SPECIAL IMPROVEMENT PROJECTS

Project plans will be developed by DWR in cooperation with the local agency, the public beneficiary, and DFG. Project plans will be subject to the approval of the appropriate local agency or agencies, and DFG. DFG will make a written determination as part of its review and approval of a plan or project whether the proposed expenditures are consistent with a net long-term habitat improvement program and would result in a net benefit for aquatic species in the Delta.

2.2.5 EXECUTION OF PLANS

Special improvement projects will be undertaken and completed in accordance with the approved project plans. Project works may be undertaken by DWR or, at DWR's option, by the local agency pursuant to an agreement with DWR.

In addition to any obligations assumed under an agreement with DWR and to the extent consistent with that agreement, the local participating agency will (1) provide construction access to lands or rights-of-way that it owns or maintains for flood control purposes or for purposes that are compatible with the project's required use and necessary to complete the project; (2) maintain the completed project; (3) apply for federal disaster assistance, whenever eligible, under PL 93-288; (4) hold and save the State and its employees free from any and all liability for damages, except that caused by gross negligence, that may arise out

Table 5. Special Projects Matrix of Objectives and Attributes

Objective	Island Attribute
Life and personal property	Permanent population Towns Housing units Residential lands
Water quality	Long-term salinity intrusion induced Critical to water quality (Senate Bill 34) Island volume
Agricultural production	Total agricultural lands Value of damagable crops
Recreation	State or regional parks Recreation lands Recreation resorts/marinas
Cultural resources	Known prehistoric sites Potential historic sites
Ecosystems	Native vegetation Wetlands Riparian habitats Agricultural waterfowl habitats Known special-status plant occurrences Known special-status wildlife occurrences
Infrastructure of local concern	County roads Commercial lands Industrial lands Acreage protected per levee mile
Infrastructure of statewide concern	Federal and state highways Water supply conveyance Railroad mainlines Natural gas pipelines Natural gas fields and storage Power transmission lines
Adjacent island resources	Adjacent levees at risk Seepage risk

of the construction, operation, or maintenance of the project; (5) acquire easements; (6) comply with habitat mitigation and improvement requirements; and (7) use subsidence control alternatives.

2.2.6 MAINTENANCE

Prior to the adoption of any maintenance criteria, the Board will hold public hearings and revise the criteria as deemed necessary.

Completed special improvement projects will be maintained by the local cooperating agency pursuant to maintenance criteria adopted in accordance with Section 12984 of the California Water Code. This section requires DWR to develop and submit for approval by the Board,

criteria for the maintenance and improvement of levees. The criteria will be adapted to meet specific conditions; be multipurpose; and include environmental considerations, when feasible. The non-project levee maintenance criteria will embody and implement the mitigation plan set forth in the "Flood Hazard Mitigation Plan for the Sacramento-San Joaquin Delta" and the "Vegetation Management Guidelines for Local Non-Project Delta Levees." Project levee and eligible non-project levee maintenance criteria also will comply with the PL 84-99 Delta Specific Standard, the Corps' "Standard Operation and Maintenance Manual," and each applicable supplemental agreement. PL 84-99 Levee Maintenance standards allow significantly less vegetation than the "Vegetation Management Guidelines for Local, Non-Project Delta Levees," that was approved for the HMP standard. Replacement of the HMP vegetation guidelines with the PL 84-99 vegetation standard on non-project levees likely will result in greater habitat mitigation and enhancement requirements through the AB 360 program. Prior to the adoption of any maintenance criteria, the Board will hold public hearings and revise the criteria as deemed necessary.

2.3 DELTA LEVEE SUBSIDENCE CONTROL PLAN

The goals of the Delta Levee Subsidence Control Plan (Subsidence Control) element are to reduce or eliminate the risk to levee integrity from subsidence and assist in the coordination of subsidence-related linkages with other CALFED programs. This element is being developed and evaluated at a programmatic level. Appendix E contains two subsidence reports developed by the Subsidence Subteam. One report discusses the effects of subsidence on levee integrity, presents a preliminary subsidence mitigation plan for levee integrity, and delineates target areas for subsidence control based on the best available information. The other report presents a broader perspective in an evaluation of subsidence as it affects all CALFED objectives.

The goals of the Delta Levee Subsidence Control Plan element are to reduce or eliminate the risk to levee integrity from subsidence and assist in the coordination of subsidence-related linkages with other CALFED programs.

2.3.1 INTRODUCTION

Subsidence issues, concerns, and solutions are addressed in both the Levee Program and the Ecosystem Restoration Program. The Levee System Integrity Program Plan focuses on subsidence that affects the levee system. Subsidence management is covered under the existing "Special Flood Control Project" portion of the California Water Code (refer to Appendix C).

2.3.2 BACKGROUND

Subsidence has substantially contributed to the Delta islands current condition of relatively tall levees that protect interiors below sea level. Recently, however, the importance of subsidence to levee stability has diminished. Land management and levee maintenance practices have improved, and subsidence rates have decreased. In addition, the Subsidence Subteam has determined that a zone of influence (ZOI) extends from the levee crest to some distance inland, beyond which subsidence will not affect levee integrity.

Subsidence has substantially contributed to the Delta islands current condition of relatively tall levees that protect interiors below sea level.

Although the ZOI for a reach of levee can be determined with site-specific data, the Subsidence Subteam has estimated the ZOI for planning purposes. Based on available information and engineering judgement, the ZOI is roughly estimated to range from 0 to 500 feet from the levee crest, depending on site-specific conditions. The Subsidence Control element addresses subsidence as it affects levee integrity within the ZOI adjacent to levees.

Table 6 lists implementation objectives, targets, and actions associated with the Subsidence Control element.

2.3.3 REMEDIAL ACTION AND PREVENTION

Potential levee settlement/subsidence mitigation actions that should be considered include:

- Geotechnical engineering principles and practices in conjunction with proven construction methods should be applied. Levee subsidence will continue as long as levee building and repair continue to add loads onto weak, compressible foundations.
- Seepage control, dewatering efforts, excavations, and land management activities near levees should be modified to minimize adverse impacts on levee integrity.
- Stability and drainage berms should be strategically located and sequentially constructed to minimize or prevent levee deformation.
- Land leveling and other ground surface modifications (for example, ditching) should be restricted within the ZOI. High groundwater levels and vegetative growth could be tolerated in some areas to accommodate measures aimed at reducing subsidence due to oxidation.

As long as subsidence is adequately managed within the ZOI, levee integrity should be unaffected. Subsidence control and monitoring are most important for the western and central Delta islands, where the depth of organic soils are the greatest and the organic content of the deposits are commonly high. Previous attempts at prioritizing areas and islands, based on depth of peat and organic matter content, provide a good starting point for the development of a subsidence monitoring, control, and prevention program.

Subsidence control and monitoring are most important for the western and central Delta islands, where the depth of organic soils are the greatest and the organic content of the deposits are commonly high.

The levees identified as target areas for subsidence remedial action and prevention would require screening and integration with other issues affecting levees, such as seismic stability requirements and Delta water operations. This integration would allow a better prioritization of future subsidence remediation of Delta levees.

2.3.4 CURRENT PROGRAM

The California Water Code's Special Flood Control Projects Program states that local agencies will acquire easements from the crown along levees for the control and reversal of subsidence in areas where DWR determines that such an easement is desirable to maintain structural stability of the levee. The easement would: (1) restrict the use of the land

Table 6. Implementation Objectives, Targets, and Actions Associated with the Delta Levee Subsidence Control Plan

Implementation Objective	Target	Action
Reduce the risk to levee integrity from subsidence	Reduce, eliminate, or reverse subsidence adjacent to affected levees	Implement current BMPs to correct subsidence effects on levees
		Fund grant projects to develop BMPs that address subsidence as it affects levee integrity
Improve the permitting process	Reduce the time required to acquire all necessary permits	Develop a uniform process to coordinate and approve all permits
		Provide regional mitigation banking
		Coordinate with the Ecosystem Restoration Program to provide an environmental enhancement component
Coordinate subsidence-related linkages with other CALFED programs	Develop and implement BMPs to facilitate CALFED objectives	Assist CMARP activities to quantify the effect and extent of inner-island subsidence and its linkages to all CALFED objectives

Notes:

BMPs = Best management practices.
CMARP = Comprehensive Monitoring, Assessment, and Research Program.

to open space uses, non-tillable crops, the propagation of wildlife habitat, and other compatible uses; (2) provide full access to the local agency for levee maintenance and improvement purposes; and (3) allow the owner to retain reasonable rights of ingress and egress, as well as reasonable rights of access to the waterways for water supply and drainage. In addition, the current program states that local agencies will use subsidence control alternatives, where appropriate, to reduce long-term maintenance and improvement costs.

2.3.5 PROPOSED PROGRAM

Subsidence monitoring would begin with an evaluation of existing soils and their distribution in the Delta, and a determination of land surface elevation.

CALFED will implement a subsidence control and monitoring program. Subsidence control measures will be incorporated into base level and special improvement projects. Subsidence monitoring would begin with an evaluation of existing soils and their distribution in the Delta, and a determination of land surface elevation. Efforts would be directed to areas on and adjacent to the levees, within the ZOI. From a new, continually updated database, a target list of levees and islands being affected by subsidence could be maintained. Monitoring would allow subsidence control to be adaptively managed as levees are rehabilitated. This monitoring effort would be coordinated through CALFED's Comprehensive Monitoring, Assessment, and Research Program (CMARP).

The Levee Program recommends that CMARP quantify the extent and effect of inner-island subsidence.

In addition, because the linkages of inner-island subsidence to CALFED objectives needs more study, the Levee Program recommends that CMARP quantify the extent and effect of inner-island subsidence. CALFED may implement grant projects to develop best management practices (BMPs) that restore interior island elevations.

2.4 DELTA LEVEE EMERGENCY MANAGEMENT AND RESPONSE PLAN

The goal of the Delta Levee Emergency Management and Response Plan (Emergency Management Plan) element is to enhance existing emergency management response capabilities in order to protect critical Delta resources and limit any interruption of services and supplies to 6 months or less in the event of a disaster. More focused analysis and documentation of specific targets and actions will occur in subsequent efforts.

The goal of the Delta Levee Emergency Management and Response Plan element is to enhance existing emergency management response capabilities in order to protect critical Delta resources and limit any interruption of services and supplies to 6 months or less in the event of a disaster.

2.4.1 INTRODUCTION

The existing emergency response capabilities need to be continuously refined, and funding needs to be increased. The Emergency Management Plan will build on existing state, federal, and local agency emergency management. It will propose specific actions that will improve response flexibility to ensure that appropriate resources are available and properly deployed, and provide for effective disaster recovery measures.

Table 7 lists implementation objectives, targets, and actions associated with the Emergency Management and Response Plan element.

2.4.2 BACKGROUND

The most recognizable threat to Delta islands and resources is inundation due to winter flood events. Other potential disasters that threaten these same resources include seismic events and levee failure during low-flow periods.

The most recognizable threat to Delta islands and resources is inundation due to winter flood events.

Current emergency response procedures could be streamlined to reduce delays in mobilizing resources. A quick response can prevent costly levee failures. In addition, the tendency to focus emergency response measures on those sites facing imminent failure can result in neglecting actions that could prevent threatened sites from escalating into emergencies.

2.4.3 CURRENT PROGRAM

The Governor's Office of Emergency Services (OES) coordinates state agency responses. When an incident appears to potentially exceed the resources of the local responsible agency, emergency personnel conduct on-site evaluations to determine what, if any, additional emergency support is warranted. Cities and counties can proclaim local disaster events and, in general, local or maintaining agencies are first in line for responsibility to address disaster events. Although certain agencies may have resources to provide initial emergency action, typically they cannot provide a sustained effort during a large disaster event. Most local agencies do not have the resources to address major disaster events, and existing agreements may provide a means for sharing additional resources from surrounding areas. The federal government provides financial assistance through FEMA under a

presidential declaration of disaster; however, other federal agencies such as the Corps may provide assistance or resources under existing authorities.

Table 7. Implementation Objectives, Targets, and Actions Associated with the Delta Levee Emergency Management and Response Plan

Implementation Objective	Target	Action
Enhance emergency response capabilities and resource allocation	Develop the capability to efficiently respond to multiple concurrent levee breaks within the Delta and limit interruption of services to 6 months or less	Implement a comprehensive reconstruction, repair, and maintenance program for Delta levees
		Review, clarify, and refine command and control protocol; develop an Integrated Response Plan in conformance with SEMS/ICS
		Define agency responsibilities to ensure environmental compliance
		Purchase materials in advance and place in strategic locations
		Execute pre-negotiated contracts with contractors for forces and equipment to respond with short notice
		Clarify program eligibility, inspection, documentation, dispute resolution, auditing, and reimbursement procedures
Develop a stable funding source for emergency response	Provide funding for a well-defined Disaster Assistance Program	Prepare cost estimates
		Identify beneficiaries to provide equitable distribution of costs
		Develop funding sources

Notes:

ICS = Incident Command System.
SEMS = Standardized Emergency Management System.

The existing emergency management structure is designed to coordinate activities of multiple state, federal, and local agencies with varying responsibilities to provide emergency assistance in the event of a disaster. The Standardized Emergency Management System (SEMS) provides a framework for coordinating state and local government emergency response in California, using the Incident Command System (ICS) and mutual aid agreements. SEMS facilitates setting priorities, cooperation among agencies, and the efficient flow of resources and information.

2.4.4 PROPOSED PROGRAM

CALFED plans to build on the existing emergency response system. CALFED's Emergency Response Subteam determined that an effective Delta levee emergency response program should be concentrated in seven areas:

CALFED plans to build on the existing emergency response system.

- Funding;
- Response by state and federal agencies;
- Availability of flood fight resources;
- Integrated response;
- Clarification of regulatory procedures;
- Clarification of program eligibility, inspection, documentation, auditing, and reimbursement procedures; and
- Dispute resolution.

Funding

The vulnerability of the levee system can be reduced by implementing an integrated and comprehensive reconstruction, repair, and maintenance program for Delta levees and channels, as described and recommended under the Levee System Integrity Program. Implementation can be accomplished only by supplementing local funding capability through state and federal cost-sharing at adequate and consistent levels.

Response by State and Federal Agencies

- DWR's authority to respond should be clarified and expanded to include all instances where levees or other flood control structures are in danger of failure, regardless of whether the danger is due to storms, floods, earthquakes, rodents, vessel impacts, or any other cause. The funding for support of DWR's efforts should be ample and clearly committed for a comprehensive emergency response.

  The role of the Corps also should be clarified and confirmed, to eliminate delay in response and avoid any dispute concerning whether the local and state responses are sufficient.

- DWR should be given the mandate, authority, and funding to carry out the repair of damage to Delta non-project levees due to floods, storms, and levee failure incidents—including de-watering flooded areas. All FEMA and OES funds related to such work should go directly to DWR.

Availability of Flood Fight Resources

Specialized Equipment and Operators

A revitalized levee maintenance capability under the Levee System Integrity Program will establish a fleet of specialized equipment essential to a rapid emergency response but will not ensure its availability during emergencies that can widely range in geographic extent. Pre-emergency contracting for specialized equipment will secure the availability of the equipment and experienced operators and will establish the pricing for emergency services.

A revitalized levee maintenance capability under the Levee System Integrity Program will establish a fleet of specialized equipment essential to a rapid emergency response but will not ensure its availability during emergencies that can widely range in geographic extent.

Material Stockpiles

DWR (Central District) has established stockpiles for flood-fighting material (such as sandbags, plastic, stakes, light equipment, and pumps) at three locations in the north, south, and west Delta. The program should include assurance of a supply or stockpiling of sand, drain rock, and riprap.

Staffing for Emergency Assistance

Formalizing arrangements with the California Department of Forestry and Fire Prevention, as well as with the California Conservation Corps and the State Prison System, for emergency assistance should be considered.

Integrated Response

A detailed response plan should be developed for the Delta that would allow an immediate, simultaneous response to a serious incident by all levels of government within a single integrated organizational structure. The plan would identify common needs and functions of all agencies (for example, housing, food, transportation, supplies [including rock and sand], equipment, and contracted services) and would assign the most capable agency or jurisdiction to perform each action on behalf of all agencies. The detailed response plans would provide the basis for pre-identifying and assigning specific responsibilities for each agency, as well as the level of resources that the individual local agency would be expected to provide in response to the emergency. With detailed assignment of responsibilities, an organizational structure for the "area command" could be delineated to ensure that the "incident commands" were coordinated.

A detailed response plan should be developed for the Delta that would allow an immediate, simultaneous response to a serious incident by all levels of government within a single integrated organizational structure.

Clarification of Regulatory Procedures

Although both state and federal laws suspend environmental regulation during emergencies, some clarifications are desirable.

- A consistent definition of "emergency" should be developed for response and regulatory activities. It is especially important that the defined duration of the emergency be consistent for both purposes.

- Mitigation measures that are expected during post-emergency recovery work should be defined, to rapidly define and implement "appropriate" mitigation and to avoid

unnecessary delays of post-emergency recovery work. Fish and Game Code Section 1600 outlines only general obligations.

Clarification of Program Eligibility, Inspection, Documentation, Auditing, and Reimbursement Procedures

The requirements of state and federal programs need to be standardized to be consistent with one another, be well communicated to the local agencies without delays, and avoid changes or re-interpretation during the reimbursement process.

Dispute Resolution

A binding arbitration procedure, conducted by knowledgeable but impartial arbiters, should be established. The procedure should encompass state and federal programs.

2.5 DELTA LEVEE RISK ASSESSMENT AND RISK MANAGEMENT STRATEGY

Delta levees and islands are at risk of failure from floods, seepage, subsidence, earthquakes, and other threats. A key management decision will be made at the end of Stage 1 implementation regarding the effectiveness of the CALFED Preferred Program Alternative. The following key levee-related question must be answered at the end of Stage 1: "Are the risks to export water supply from levee failure acceptable, or are other actions required?" To address these needs, CALFED will develop and implement an appropriate risk management strategy during Stage 1. The goal of the Delta Levee Risk Assessment and Risk Management Strategy is to quantify the risks to Delta levees, evaluate the consequences, and develop an appropriate risk management strategy.

The goal of the Delta Levee Risk Assessment and Risk Management Strategy element is to quantify the risks to Delta levees, evaluate the consequences, and develop an appropriate risk managements strategy.

2.5.1 INTRODUCTION

Many CALFED agencies and stakeholders have voiced concern over the need to quantify Delta levee risk, to determine the consequences of failure, and to implement an appropriate risk management strategy.

The greatest threat to Delta levees is overtopping and seepage during flood flows. Since their reclamation, numerous Delta islands have flooded at least once. Over the past 50 years, dozens of islands have flooded. Some islands have flooded many times. Some islands were never reclaimed. The vulnerability of the Delta levee system to failure during earthquakes is also a concern. Although levee failure from a seismic event has never been documented, the Delta has not experienced a significant seismic event since the levees reached their current size. The risk to Delta resources must be managed if the CALFED objectives are to be achieved. Appendix D lists the major resources in the Delta.

2.5.2 PAST AND PRESENT EFFORTS

Over the past 12 years, the existing Delta levee program has reduced the risk of flood and seepage by improving Delta levees.

Over the past 12 years, the existing Delta levee program has reduced the risk of flood and seepage by improving Delta levees.

Research and demonstration projects are being conducted to quantify the effects of subsidence and determine how to reduce its threat to Delta levees.

In the late 1980s, DWR's Division of Engineering embarked on a long-term seismic stability evaluation of Delta levees. Strong-motion accelerometers were installed at several sites in the Delta. Field and laboratory testing is being done to better determine the static and dynamic properties of organic soils and to better determine their liquefaction potential. The potential activity of the Coast Range/Sierra Nevada Boundary Zone is being evaluated. In 1992, DWR published a report titled, "Seismic Stability Evaluation of the Sacramento-San Joaquin Delta Levees - Volume I." DWR's seismic investigation is being continued. DWR continues to collect data from their seismic monitoring instruments, and continues field and laboratory testing. These data will be published in future reports.

In 1998, a Seismic Vulnerability Subteam began a seismic risk assessment of Delta levees. The sub-team was comprised of a group of experts in the fields of seismology and geotechnical engineering. The assessment identifies the risk to Delta resources during catastrophic seismic events and comments on the general feasibility of various actions to reduce exposure to the risk. The Seismic Vulnerability Subteam's report, "Seismic Vulnerability of the Sacramento-San Joaquin Delta Levees," dated April 2000, is included in Appendix G of this document.

"... A significant seismic risk is present; however, improved preparedness can reduce the potential damage."

2.5.3 PROPOSED RISK ASSESSMENT

As part of CALFED's Stage 1 actions, CALFED staff will work with stakeholders, the public, and state and federal agencies to develop and implement a Delta Levee Risk Assessment and Risk Management Strategy. CALFED will incorporate the findings from the Seismic Vulnerability Subteam's assessment into an overall risk assessment. Once the risk to Delta levees is quantified and the consequences are evaluated, CALFED will develop and implement an appropriate risk management strategy.

CALFED staff will work with stakeholders, the public, and state and federal agencies to develop and implement a Delta Levee Risk Assessment and Risk Management Strategy.

Several risk management options have been developed for inclusion in the CALFED Preferred Program Alternative. The available risk management options include, but are not limited to:

- Improving emergency response capabilities,
- Reducing the fragility of the levees,
- Improving through-Delta conveyance,
- Constructing an isolated facility,
- Developing storage south of the Delta,
- Releasing more water stored north of the Delta,
- Restoring tidal wetlands,
- Controlling and reversing island subsidence,
- Curtailing Delta diversions, and
- Continuing to monitor and analyze total risk.

The final Risk Management Plan will include a combination of these options and others identified as a result of the risk assessment.

Table 8 lists implementation objectives, targets, and actions associated with the Delta Levee Risk Assessment and Risk Management Strategy Element.

Table 8. Implementation Objectives, Targets, and Actions Associated with the Delta Levee Risk Assessment and Risk Management Strategy Element

Implementation Objective	Target	Action
Prepare a Delta Levee Risk Assessment and Risk Management Strategy	Document findings in a report to CALFED	Assemble a Levee Risk Assessment Team Quantify risks to Delta levees from earthquakes, overtopping, seepage, and subsidence Quantify the consequences to resources at risk Develop potential risk management strategies that are consistent with CALFED's Preferred Program Alternative; coordinate with CALFED program managers, agencies, and stakeholders; develop viable funding methodologies Make recommendations to CALFED on specific risk management actions and funding methodologies
Implement appropriate risk management strategies	Integrate risk management strategies into CALFED's Preferred Program Alternative	CALFED to take appropriate action on selected risk management actions